



Brain Quiz

This *Brain Quiz* was created to introduce some of the basic concepts concerning early brain research in a way that challenges us to think critically and creatively about what we have heard about the research. Test yourself to see what facts and misinformation you have heard concerning infants and brain development.

- T or F** Basic brain connections are laid down before birth.
- T or F** Babies are born with the ability to learn all the languages in the world.
- T or F** A human baby's brain has the greatest density of brain cells connectors (synapses) by age three.
- T or F** Because the brain is making so many connections pre-birth to age three, the first three years of life are the most critical for brain development. After age three, the "window of opportunity" closes.
- T or F** Good nutrition is one of the best ways we know to aid healthy brain development.
- T or F** Reading to a newborn infant is the best way to help a child learn to read in the future.
- T or F** Living in an orphanage as a baby will likely result in negative, long-lasting effects on the brain.
- T or F** There are times when a negative experience or the absence of appropriate stimulation is more likely to have serious and sustained effects on the child.
- T or F** The large majority of what we've learned about the brain comes from research conducted on animals rather than on humans.
- T or F** Brain research has been misunderstood and misapplied in many contexts.

Resource: Center for Early Education and Development, Irving B. Harris Training Center for Infant and Toddler Development. *Talking Reasonably and Responsibly about Early Brain Development*. 2001. Regents of the University of Minnesota.

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Answers to Brain Quiz

Basic brain connections are laid down before birth. True

- During pregnancy, the basic architecture of the brain is formed. The different parts of the brain are in place (e.g., brain stem, thalamus, cerebellum). This initial development also provides basic brain functions that help the baby live.
- Although this "hardware" is laid out during pregnancy, the brain is still immature in that the "software," or the connections between different parts of the brain, are not yet formed.
- To a certain extent, formation of the connections depends on exposure to our environment – through relationships and experiences.
- Unlike the other organs of the newborn, such as the heart which is already functioning as it will throughout the child's life, the brain is not yet ready to perform all the amazing functions it will eventually be able to do. It goes through a series of developmental stages. It is following birth that experience begins to have a greater effect on brain development than it did during pregnancy (although, certain experiences, such as maternal health and stress, intake of drugs and/or alcohol, and quality of maternal nutrition, do influence the developing brain during pregnancy,).

Babies are born with the ability to learn all the languages in the world. True

- The infant brain is "wired" to seek out and learn language.
- Amazingly, infants are born with the capacity not just to learn language, but to learn all languages. As researcher Patricia Kuhl from the University of Washington puts it, infants are "citizens of the world." They are able to perceive the different sounds and patterns of speech of all languages in the world. For example, at birth, Japanese babies can hear the distinction between "r" and "l", although only the "r" sound exists in Japanese. They can still hear the distinction at 6 months of age, but cannot by 12 months of age.
- Even in the womb, the infant is turning towards the melody of its mother's voice. The brain is setting up the circuitry needed to understand and reproduce language.
- Babies learn to talk by hearing language and having language directed at them in "conversation."
- Between 6-12 months, babies begin to fine-tune their ability to perceive the speech sounds of their native language as opposed to non-native language.

*A human baby's brain has the greatest density of brain cells connectors (synapses) by age three. **True***

- Researchers who have studied the brains of both monkeys and humans have shown that there is a pattern of rapid synapse formation during early development.
- However, this density does not remain throughout life. After these connections are formed, there is a "plateau period" and then a period of pruning, or elimination, where the densities decrease and resemble adult levels.
- In humans, this period of elimination begins around early adolescence and continues until at least age 16.
- Different parts of the brain undergo synapse formation, plateau, and elimination at different points in development, depending upon when they mature.

*Because the brain is making so many connections pre-birth to age three, the first three years of life are the most critical for brain development. After age three, the "window of opportunity" closes. **False***

- You're sitting here learning something right now aren't you?!!
- Although brain connector density is at its highest level in the first three years of life, that doesn't mean that the brain has its greatest brain power at that time. A great deal of learning goes on after the first three years of life.
- However, the first three years are important for laying the groundwork for healthy psychological development. We know that from psychological research, particularly research on parent-child attachment, but not from brain development research. What we know from brain development research right now is that for very specific aspects of brain development, such as the visual system, critical periods exist and thus a window of opportunity.
- The brain continues to grow and mature well into adolescence; thus, it is virtually impossible to make the general claim that the window of opportunity closes by age three. (Nelson, 2000a)
- The brain is adaptable and flexible, although the ability to adapt changes with age and situation. In reality, there are many windows of opportunity throughout development. Knowing that the brain is more flexible than previously thought doesn't mean that it's easy to change the brain. It's an incredibly difficult challenge. Much more research is needed before we can make claims or suggestions about how to do that.

Good nutrition is one of the best ways we know to aid in healthy brain development. **True**

- It is important that families provide an environment that supports health in both lifestyle and nutrition.
- Good nutrition is important for both the pregnant mother and the infant. Pregnant mothers need appropriate amounts of folic acid and iron, and should avoid nicotine, alcohol, and illicit drugs throughout their entire pregnancy.
- The developing brain craves iron. Babies need an appropriate amount of iron via either breast milk or formula in the first six months of life, and via iron-fortified infant cereals and iron supplementation after that, whether or not their mothers are iron-deficient. Iron deficiency has been clearly linked to cognitive deficits in young children. Iron is critical for maintaining an adequate number of oxygen-carrying red blood cells, which in turn are necessary to fuel brain growth. Bottle-fed babies should receive formula that contains iron.
- Breast milk contains all the amino and fatty acids needed for brain development. Some research has shown that babies who are breast-fed as compared to babies who are formula-fed have scores that are significantly higher on IQ tests.
- Children who are malnourished – not just fussy eaters, but truly deprived of adequate calories and protein in their diet – between mid-gestation and two years of age do not adequately grow, either physically or mentally. Their brains are smaller than normal and they often suffer lasting behavioral and cognitive deficits, including slower language and fine motor development, lower IQ, and poorer school performance.

Reading to a newborn infant is the best way to help a child learn to read in the future. **False**

- It is important to recognize that what is most important is providing a language-rich environment for children. Reading is one way, but there are many other ways as well, such as talking, singing, listening to music.
- There are a number of studies that show that when children hear a good deal of "live" language, when they are spoken to often and encouraged to communicate, they are more proficient with language than children who have more limited language exposure. For example, Janellan Huttenlocher, University of Chicago, found that at 20 months of age children of "chatty" moms averaged 131 more words than kids of "non-chatty" moms and by age two, the gap had increased to a difference of 295 words. Only live language, not television, produced these vocabulary-boosting effects (Begley, 1997).
- Risley & Hart, in their 1995 book *Meaningful Differences in the Everyday Lives of American Children*, compared the early language environments of children from 7-9 months until 3 years, and then correlated language

exposure to achievement test scores in third grade. Children who heard the greatest amount of language when they were young had the highest achievement test scores, while children who heard the least amount of language had the lowest achievement test scores.

*Living in an orphanage as a baby will likely result in negative, long-lasting effects on the brain. **False***

- Non-responsive, inconsistent care can set children up for cognitive, social, emotional and physical problems.
- This is a complicated issue; intervention can make a difference.
- Studies of children reared in orphanages in the first few years of life suggest that children's developmental outcomes are better when children are adopted by the time they are six months of age (Nelson, 2000c).
- However, there are numerous instances of children who were adopted after the first year of life who experience catch-up growth and developmental improvements.
- Scientists believe that harmful behaviors or neglect in early life can affect the brain, leading to lifelong problems. A healthy and caring environment, however, can create opportunities for the child to develop to his or her full potential.
- High quality caregiving experiences, particularly for young children who experience abuse or neglect, can support the healthy development of the stress system.

*There are times when a negative experience or the absence of appropriate stimulation is more likely to have serious and sustained effects on the child. **True***

- Early exposure to nicotine, alcohol and/or drugs can have devastating effects on the developing brain, particularly during the time during pregnancy when the brain is being formed.
- Critical periods in brain development do exist, although we have a long way to go to understand them. We know that the absence of a reasonable amount of light in the first weeks after birth alters the development of the visual system (e.g., development of binocularity is not possible), and that the complete absence of hearing language or receipt of extremely poor care (such as in an orphanage) will likely result in developmental deficits, but we still have much to learn about the persistence of these effects and the ability of the brain to overcome them.
- In general, although some critical periods do exist, the concept of sensitive periods better explains early development. Sensitive periods are times in development when certain kinds of experiences are essential for healthy development, when the absence of some kind of stimulus results in development going awry, or off-course. Compared to critical periods, sensitive periods are generally longer and suggest that there is more

flexibility in the timing of input or experience to the brain and the brain's ability to learn and develop over time.

The large majority of what we've learned about the brain comes from research conducted on animals rather than on humans. **True**

- The bulk of cognitive neuroscience research has been conducted on animals, such as rats and monkeys. These animal models provide us with hypotheses about how things might work in the human brain, but they are not perfect analogs. So, what we learn about animals may be meaningful but still needs to be documented in humans.
- This also means that we need to be careful about the extent to which the claims about brain research can legitimately be made about human brain development.
- Currently, a great deal of knowledge is being generated about both animal and human brain function. The core, basic knowledge on how brains develop and function is being compiled. However, as the picture is not yet complete, it is difficult at this time to use current research to inform prevention or intervention in relation to problems in the brain.

Brain research has been misunderstood and misapplied in many contexts. **True**

- Many are concerned about the potential misuse of the brain research to marginalize oppressed populations, particularly children of color or children living in poverty. For example, the size of the brain and how the brain works has been used to rationalize oppression in the past.
- Recommendations for certain kinds of parenting practices have been offered with the notion that they are based on brain development research when, in fact, they are based in psychological and educational research. They may be fine recommendations, but they aren't based on knowledge from early brain development.
- It is important that accurate information get communicated to parents and child care providers – in making public policy, in prevention and intervention, and in providing opportunity for all children including ethnic minorities or children living in poverty.

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Brain Development Assignment

1. Instruct the participant(s) to visit the BrainWonders website at the following location and review the information found on the topic of *Brain Development: Frequently Asked Questions*. Information is available there on general brain development, and pre- and post-natal brain development. This activity is to be done independently by the participant.

<http://www.zerotothree.org/brainwonders/FAQ.html>

2. Instruct the participant(s) to access handouts titled *Healthy Minds Nurturing Your Child's Development* on the website below or provide them with copies. Ask them to read the seven age-specific handouts (two pages each) for birth to three year olds. These handouts are based on findings from the landmark report, *Neurons to Neighborhoods*, from the National Academy of Sciences. They summarize key findings, provide a child description, describe typical development for the age represented, and make suggestions for caregivers for nurturing their child's development. Review of this material gives the service coordinator the opportunity to refresh his/her knowledge of the nature of early child development and the impact early experiences have on children's health and well-being. Understanding typical child development is foundational for performing the duties of service coordination.

www.zerotothree.org/healthyminds/main.html

3. Additional Information on child development and developmental milestones is available from the home page below in areas titled *Parents* and *Child Care Providers*. Instruct the participant(s) to review information, as needed, based on their personal level of expertise and experience related to typical child development.

<http://www.zerotothree.org/brainwonders/index.html>

4. When the participant has completed this assignment, list the date completed in their *Documentation of Portfolio Results*.

BrainWonders: Developed (1998-2001) Boston University School of Medicine, Erikson Institute, and ZERO TO THREE. [Online]. Available: <http://www.zerotothree.org/brainwonders/FAQ.html> [Retrieved: 2004, April 1].

Healthy Minds Nurturing Your Child's Development (2002) ZERO TO THREE. [Online]. Available: www.zerotothree.org/healthyminds/main.html [Retrieved: 2004, April 7].

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